PVP 20

Code: 20ME3403

II B.Tech - II Semester – Regular / Supplementary Examinations
MAY - 2023

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.
BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	How do you compare SI and CI Engines?	L1	CO1, CO2	7 M
	b)	Explain i)swept volume, ii)clearance volume, iii)mean effective pressure, iv)top and bottom dead centers v)torque	L2	CO2	7 M
OR					
2	a)	Define brake power and explain how it is measured.	L2	CO2	3 M
	b)	A four stroke petrol engine with a compression ratio of 8:1 and total piston displacement of 5.2×10^{-3} m^3 develops 100 kW brake power and consumes 33 kg of petrol per hour of calorific value 44300 kJ/kg at 3000 rpm. Find: i) Brake mean effective pressure, ii) Brake thermal efficiency iii) Air standard efficiency (Take	L2	CO2	11 M

		γ as 1.4); and iv) Air-fuel ratio by mass. Assume a volumetric efficiency of 80%. One kg of petrol vapor occupies 0.26 m^3 at 1.013 bar and 150^oC. Take R for air as 287 J/kg K.			
		UNIT-II			
3	a)	Explain the fuel requirements for both SI and CI engines.	L2	CO1, CO2	7 M
	b)	Describe the factors influencing delay period and knocking in CI engines.	L2	CO2	7 M
		OR			
4	a)	Distinguish the phenomenon of knocking in SI and CI engines.	L2	CO2	5 M
	b)	What are different stages of combustion in SI engines? Explain with p-θ diagram.	L2	CO2	9 M
		UNIT-III			
5	a)	What is regeneration? Draw the schematic and T-s diagrams for an ideal regenerative cycle.	L3	CO3	7 M
	b)	In a steam power plant operating on an ideal Rankine cycle, the steam enters the turbine at 3 MPa and 400ºC and it is exhausted at 10 kPa. Determine (i) thermal efficiency (ii) thermal efficiency, if the steam is superheated to 500ºC at 3 MPa, before it enters the turbine (iii) Thermal efficiency, if steam enters the turbine at 10 MPa and 400ºC.	L3	CO3	7 M
		OR			

6	a)	Explain briefly the methods to improve thermal efficiency of Rankine cycle.	L2	CO3	4 M
	b)	Steam enters the turbine of a steam power plant, operating on Rankine cycle, at 10 bar,300^{o}C.The condenser pressure is 0.1 bar.Steam leaving the turbine is 90% dry. Calculate the adiabatic efficiency of the turbine and also the cycle efficiency, neglecting the pump work.	L2	CO3	10 M
		UNIT-IV			
7		Explain briefly the following types of jet condensers:(i) parallel-flow type (ii) counter-flow type (iii) ejector flow type	L2	CO4	14 M
		OR			
8	a)	Discuss the merits and demerits of surface condensers over jet condensers.	L2	CO4	4 M
	b)	Dry-saturated steam at a pressure 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. The flow is adiabatic and frictionless, and neglects the inlet velocity of steam. If the isentropic specific enthalpy drop between inlet and exit is 180 KJ/kg, what will be the exit velocity of steam?	L4	CO4	10 M
		UNIT-V			
9	a)	Derive the thermal efficiency of Brayton cycle in terms of pressure ratio and polytropic index.	L4	CO4	7 M

	b)	A constant pressure open cycle gas turbine plant works between temperature range of 15ºC and 700ºC and pressure ratio of 6. Find the mass of air circulating in the installation, if it develops 1100 kW. Also find the heat supplied by the heating chamber.	L2	CO4	7 M
OR					
10	a)	Differentiate between closed cycle and open cycle gas turbine plants.	L2	CO4	4 M
	b)	In an air-standard regenerative gas turbine cycle, the pressure ratio is 5. Air enters the compressor at 1 bar, 300 K and leaves at 490 K. The maximum temperature in the adiabatic cycle is 1000K. Calculate the cycle efficiency, given that the efficiency of the regenerator and the adiabatic efficiency of the turbine are each 80%. Assume for air, the ratio of specific heats is 1.4. Also show on T-s diagram.	L4	CO4	10 M